BEFORE THE NORTH CAROLINA UTILITIES COMMISSION
DOCKET NO. E-2, SUB 1142

In the Matter of	**)**
Application of Duke Energy Progress,	**)**
LLC for Adjustment of Rates and	**)**
Charges Applicable to Electric Service	**)**
in North Carolina	**)**

DIRECT TESTIMONY OF CAROLINE GOLIN ON BEHALF OF NORTH CAROLINA SUSTAINABLE ENERGY ASSOCIATION

I. INTRODUCTION

Q PLEASE STATE YOUR NAME, TITLE, AND EMPLOYER.

A. My name is Caroline Golin. I am the Southeast Regulatory Director for Vote Solar.

Q. PLEASE STATE YOUR EDUCATIONAL AND OCCUPATIONAL EXPERIENCE.

A. I received my Masters in Civil Engineering and PhD in Energy Policy from the Georgia Institute of Technology. I have authored over thirty research papers and reports related to the use of distributed resources to achieve localized distribution planning objectives, renewable energy policy, resource planning, and rate design strategies to incentivize efficiency and effective distributed energy resource use. I have also testified or prepared reports relating to distributed energy resource planning, grid modernization, utility financial analysis, and the costs and benefits of renewable energy, in or related to cases before public utility commissions in Georgia, South Carolina, Ohio, Florida, Kansas, and North Carolina. My full CV is provided as Exhibit CG-1 to this testimony.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING?

A. I am testifying on behalf of North Carolina Sustainable Energy Association ("NCSEA"), an intervenor in this proceeding.

Q. HAVE YOU TESTIFIED PREVIOUSLY BEFORE IN FRONT OF THE NORTH CAROLINA UTILITIES COMMISSION?

A. No.

Q. HAVE YOU TESTIFIED PREVIOUSLY BEFORE IN FRONT OF OTHER PUBLIC UTILITY COMMISSIONS REGARDING GRID MODERNIZATION EFFORTS?

A. Yes. I have testified before the Public Service Commission of Massachusetts and the Rhode Island Public Utilities Commission regarding grid modernization efforts in both states.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to review and evaluate the Power/Forward proposal put forward by Duke Energy Progress, LLC ("DEP" or "the Company"). I evaluate the Power/Forward proposal in terms of the efficacy of the investments proposed as well as the process for determining the reasonableness of such investments. From my evaluation, I make specific recommendations to the North Carolina Utilities Commission ("Commission") regarding the need for a formal and separate process, either through a legislative investigation or through a Commission docket, to appraise the Company's Power/Forward proposal. I recommend that such a process include the input of relevant stakeholders, as well as other components, so as to ensure that all investments made by the Company are in the best interest of the ratepayers.

Q. WHAT INFORMATION DID YOU REVIEW IN PREPARING THIS TESTIMONY?

A. I reviewed relevant pre-filed testimony of Company witnesses and relevant Company responses to information requests submitted by NCSEA and other

intervening parties. I also reviewed related shareholder and investor presentations relevant to the Power/Forward plan and public communication on the Power/Forward plan. Additionally, I reviewed grid modernization initiatives in other jurisdictions including, Rhode Island, Indiana, Illinois, Massachusetts, Michigan, Minnesota, Colorado, Ohio, Texas, Pennsylvania, Arizona, New York, and California.

Q. PLEASE PROVIDE A SUMMARY OF YOUR TESTIMONY.

A. In my testimony, I discuss how the scope and the salience of the proposed Power/Forward investments necessitate a stronger evaluation process and more thoughtful planning on behalf of the Company. I suggest that these steps will help avoid potentially wasteful and unnecessary investments and create a strong pathway for grid modernization that will benefit ratepayers. I provide a brief overview of the Company's Power/Forward plan and a summary of best practices in terms of the process for considering grid modernization. To determine these best practices, I reviewed the efforts of several jurisdictions as well as a review of related literature published by leading organizations and individuals in the field. I compare the Company's Power/Forward proposal to these best practices and fundamental tenets of prudent rate design. I conclude with a brief evaluation of the Company's Power/Forward proposal in regards to the 'types' of investments proposed.

Based on this context, my testimony presents three primary conclusions:

First, the Power/Forward proposal marks a fundamentally different investment strategy for the Company and will substantially impact the nature and the cost of electricity service moving forward. Therefore, greater attention by the Company and stronger oversight from the Commission is warranted. With a total price tag of over $13 billion,[1] the Power/Forward plan marks the largest capital expenditure put before this Commission and the largest capital expenditure ever proposed by the Company. As such, far more planning, engagement, and technical and financial analysis is needed to justify the scope, purpose, and necessity of the proposed investments.

Second, the Company's Power/Forward plan, and proposal to spend over $13 billion in capital and operations and maintenance ("O&M") plus hundreds of millions of dollars in profits,[2] has been developed without engaging in any of the best practices of grid modernization, which include setting clear and measurable goals, performing robust cost/benefit analyses, involving relevant stakeholders, and integrated distribution planning.

Third, the 'types' of investments proposed by the Company are out of step with the types of investments typically classified as grid modernization investments and rather fall under 'business as usual' investment patterns.

Q. WHAT ARE YOUR RECOMMENDATIONS TO THE COMMISSION?

A. Based on my review of the materials in this case, I offer several recommendations that are intended to better ensure that the Company's investments made as part of

[1] Direct Testimony of David B. Fountain, p. 34 ("Fountain Direct").
[2] Duke Energy Progress, LLC Response to CIGFUR Data Request No. 2-11 (Attached as Exhibit CG-2).

the proposed Power/Forward plan will have results that are fair, just, and reasonable and provide an overall benefit to ratepayers:

(1) The Commission should open a separate, generic proceeding to thoughtfully and thoroughly plan for the future of North Carolina's grid. The proceeding should be conducted in conjunction with a Commission or staff-directed stakeholder process. The stakeholder process should culminate in the production of a robust study, performed by an independent third-party, that examines multiple pathways for modernizing the grid. From my understanding, proposed Senate Bill (S.B.) 619 contemplates this result and seeks to fund:

> a comprehensive study of known and measurable costs and benefits of grid modernization investment by investor-owned electric public utilities. The study shall include an analysis of the need to enhance and modernize the electrical transmission and distribution grid in the State to ensure an electrical grid that is resilient, secure, capable of meeting future demand growth, and able to integrate new technologies.[3]

I support the approach proposed in S.B 619 and recommend that the Commission withhold any judgement on the proposed Power/Forward plan until the General Assembly acts on S.B. 619 or adjourns.

(2) As part of that separate proceeding, I recommend that the Commission establish minimum requirements for grid modernization proposals. Specifically, I recommend that the Commission require that all utility grid modernization proposals be predicated on thorough and detailed evaluations of the costs and benefits of a wide range of alternative investment proposals, including an

[3] S.B. 619 (JLCEP Study Grid Modernization), 2017-18 Session, *available at* http://www.ncleg.net/gascripts/BillLookUp/BillLookUp.pl?Session=2017&BillID=S619.

appraisal of the ability of distributed energy resources ("DERs") to provide grid services. In that manner, the Commission could direct the Company to: (i) clearly identify the goals of the proposed Power/Forward plan; (ii) define reasonable distribution planning metrics to assess the goals; (iii) develop clear metrics to gauge success and determine the effectiveness of future approved investments; and (iv) propose a method for insulating ratepayers.

(3) Additionally, the Commission could utilize the proceeding and the stakeholder engagement as an opportunity to examine whether the traditional business model is appropriate for capital expenditures regarding grid services generally and whether the traditional application of the "used and useful" standard to assess the prudence of capital investments is applicable for the proposed Power/Forward plan specifically.

II. BACKGROUND ON THE POWER/FORWARD PLAN

Q. PLEASE SUMMARIZE THE COMPANY'S PROPOSED POWER/FORWARD PLAN.

A. The Company's proposed Power/Forward plan is a massive capital investment plan targeting the transmission and distribution systems. Over the next five years, from 2017 through 2021, the Company plans to spend $1.63 billion in capital and $62.4 million in O&M, in addition to $3.2 billion of customary spend on grid operations. The Company is proposing to spend $5.4 billion over the next ten years, with Duke Energy Carolinas, LLC spending $7.8 billion over the 10-year period. While not outlined in direct testimony, the Company identified in data

responses to NCSEA that it is proposing seven major areas of investments, with the accompanied 10-year price tags.

Advanced Metering Infrastructure ("AMI"). The Company is targeting full deployment of AMI for its customers. The Company plans to spend $289 million on AMI.

Enterprise Systems Upgrades. The Company is proposing investment in back-office systems to improve the operation and management of the grid. The only concrete example the Company has provided in this category is an investment in a Distribution Management System ("DMS"). A DMS receives and analyzes data captured on thousands of sensors and automated switches. DMS can enable automated fault location and service restoration reducing manual intervention. The Company plans to spend a total of $39 million on enterprise system upgrades, however no exact numbers are provided in terms of what will be spent on what technologies.

System Intelligence and Communications Uplift. The Company proposes to invest in automated switches, grid sensors and enhanced communications. No detail on the exact investments have been provided or where the switches and sensors will be placed. The Company plans to spend $176 million on its system intelligence and communications uplift.

Transmission Improvements. The Company is proposing investment in substation and transmission line upgrades in capacity, automation, equipment modernization, physical and cyber security, and system intelligence capabilities.

Details on these exact investments, where they will be targeted and how much money will be spent have not been provided. The Company plans to spend $761 million on transmission improvements.

Distribution Hardening and Resiliency. The Company is proposing investment in retrofitting or replacing aged and/or deteriorating cable and conductors; updating physical and cyber security; improving capacity margin, and providing back feed capability to vulnerable communities. Again, details on these exact investments, where they will be targeted and how much money will be spent have not been provided. The Company plans to spend $1,565 million in this category.

Targeted Undergrounding. The majority of DEP's proposal is to invest in undergrounding of power lines. The Company proposes to target lines that have a disproportionate amount of momentary interruptions and outage events first. The Company plans to spend $2,066 million for undergrounding.

Self-Optimizing Grid. The Company is proposing to invest in added capacity in distribution circuits and substation transformers as well as connecting radial distribution circuits together with automated switches. This will be supported by the proposed DMS. To date the Company has not provided any details on these exact investments, where they will be targeted and how much money will be spent on which portions of the grid. The Company plans to spend $482 million on self-optimizing grid investments.

Q. HOW IS THE COMPANY JUSTIFYING THE INVESTMENTS FOR THE POWER/FORWARD PLAN?

A. The Company claims that in the face of growing population more investments are needed in the grid to and "to improve the performance and capacity of the aging grid, making it smarter and more resilient and give customers greater benefits."[4] The Company also claims that 30% of the current infrastructure is beyond its useful life.[5]

Q. HOW HAS THE COMPANY CALCULATED THE TOTAL AMOUNT OF INVESTMENT AND EACH COMPONENT OF INVESTMENT FOR THE POWER/FORWARD PLAN?

A. Given that the Company has not developed any specifics on the type and cost of infrastructure investments associated with the Power/Forward plan, it is unclear as to how the Company has determined a final price tag for the Power/Forward plan. It is concerning to me that the Company has a clear number of how much it will grow its rate base without having a clear plan on how it will spend the ratepayers' money.

Q. FROM REVIEW, DO YOU FIND THAT THESE ARE JUSTIFIED REASONS FOR SCOPE AND SCALE OF THE POWER/FORWARD PLAN?

A. No, I do not. And without the proper process to plan and review the Power/Forward proposal, it seems impractical to me that any one person or

[4] Direct Testimony of Robert M. Simpson III for Duke Energy Progress, LLC, p. 35 ("Simpson Direct").
[5] *Id.*, p. 7.

persons could determine its justification and ensure prudent and cost effective use of ratepayer dollars. There exist multiple pathways to improving the reliability performance of the grid and multiple investment strategies for updating aging infrastructure. The Company has chosen to pursue a single investment strategy that, from the limited information available, appears in many ways to just be a continuation of 'business as usual' investments under a new label of 'grid modernization.' To determine the *who, what, where, when, how,* and *why* of grid modernization, a more formal process is needed.

Q. IS THE COMPANY REQUESTING COST RECOVERY FOR THE POWER/FORWARD PLAN?

A. No, it is not.

Q. IF THE COMPANY IS NOT REQUESTING COST RECOVERY, WHY IS A REVIEW OF THE POWER/FORWARD PLAN WARRANTED?

A. For several reasons. First, while the Company is not requesting rate recovery, Duke Energy Carolinas, LLC ("DEC") is requesting rate recovery as part of its current general rate case in Docket No. E-7, Sub 1146. This means that the Commission will be responsible for approving the merits of the DEC proposal without clearly understanding the full scope of the Power/Forward plan. It also means that the Commission will have to simultaneously but separately review and evaluate investment plans that have clear overlap and implications for each other. It is unreasonable and impractical to expect the Commission to make decisions in

a vacuum, without a clear understanding of the full scope and implications of Duke's grid modernization investment strategies.

For these reasons, among others, I am reviewing the Company's Power/Forward plan with the goal of articulating the clear need for a separate, formal process that evaluates and reviews the Power/Forward plan in its totality, including the standard used to assess cost recovery. Given that the Power/Forward Plan accounts for 43% of Duke Energy's total electric utilities and infrastructure capital spend[6], and given that to date the Company has not conducted a single cost/benefit analysis or business case analysis,[7] it is critical that all investments be systematically planned and thoroughly evaluated, so as to provide the ratepayers with the insurance that their monies are not being wasted at the profit of the Company's shareholders.

Q. IF THE COMPANY DOES REQUEST COST RECOVERY, WHAT IS YOUR ESTIMATE OF THE POWER/FORWARD PLAN'S IMPACT ON RATEPAYERS?

A. Without a clear outline of how monies will be spent and the form of cost recovery, I am unable to provide an evaluation of the Power/Forward plan's

[6]According to Duke Energy's recent Fourth Quarter Earnings Review, Duke is investing in $30 billion in electric utilities and infrastructure. The Power/Forward plan accounts for $13 billion. Duke Energy, *Fourth Quarter Earnings Review and Business Update* (February 16, 2017), *available at* https://www.duke-energy.com/_/media/pdfs/our-company/investors/news-and-events/2017/1qresults/4q2016slidesr2.pdf?la=en.

[7] Duke Energy Progress Response to NCSEA DR5-14 (attached as Exhibit CG-3) ("DEP Response to NCSEA DR5-14"); Duke Energy Progress Response to CIGFUR DR2-10 (attached as Exhibit CG-4) ("DEP Response to CIGFUR DR2-10").

impact on ratepayers. However, early estimates expect that full adoption of the Power/Forward plan will increase residential rates by 47.8%.[8]

III. BEST PRACTICES OF GRID MODERNIZATION AND CRITIQUE OF THE COMPANY'S APPROACH TO GRID MODERNIZATION

Q. WHAT IS GRID MODERNIZATION?

A. Grid Modernization is a broad term referring to processes that seek to transform the operations and the management of the electricity grid through improved flexibility and reliability, the adoption of new information technologies and DERs, and enhanced efficiency and reliability in the distribution of electricity.

Q. WHAT ARE SOME OF THE MOST IMPORTANT FEATURES OF ANY GRID MODERNIZATION PLAN THAT UTILIZES BEST PRACTICES?

A. The literature on grid modernization, in terms of practice and process, is largely still evolving. To determine the best practices of grid modernization process, I have reviewed over twenty proceedings occurring across the country and literature from leaders in the field, including the Electric Power Research Institute ("EPRI"), Smart Electric Power Alliance ("SEPA"), North American Electric Reliability Corporation ("NERC"), the North Carolina Clean Energy Technology Center ("NCCETC"), and the Department of Energy ("DOE"). From my review, I have determined the following components are critical to a strong grid modernization effort.

[8] Presentation by Kevin O'Donnell, CFA on Behalf of Carolina Utility Customers Association, *NC Electric Rates and Job Retention* (February 17, 2017).

(1) First and foremost, any grid modernization plan should emphasize clear outcomes and defined goals. These goals should be accompanied by clear metrics that can measure the jurisdiction's progress towards these goals.

(2) Second, grid modernization plans should include input from third-party stakeholders to determine optimal pathways.

(3) Third, grid modernization investments should be predicated on thorough integrated distribution planning that provides the utility with a clear vision of where and how to invest in the grid to achieve defined outcomes.

(4) Fourth, grid modernization plans should include robust cost/benefit analyses to determine the most cost-efficient means of achieving determined goals.

(5) Fifth, grid modernization plans should further the growth and use of innovative technologies as well as access to data. Strong grid modernization plans thus result in new and improved grid investments, the expansion of services provided by DERs against baseline conditions, an information-rich service environment, and new tools for customers. A strong grid modernization plan will therefore take a system view and ALL investments will be viewed as part of a holistic plan that assesses costs, including opportunity costs, and benefits of alternative pathways for achieving the defined objectives.

I evaluate the Company's proposed Power/Forward proposal against these best practices of grid modernization, specifically the need for:

- Clear and Measurable Goals

- Stakeholder Engagement
- Integrated Distribution Planning
- Cost/Benefit Analysis

A. Clear and Measurable Goals.

Q. WHAT TYPES OF GOALS AND METRICS ARE ASSOCIATED WITH GRID MODERNIZATION?

A. My review of current grid modernization proceeding, as well as literature from SEPA[9], NCCETC,[10] Grid Wise Alliance,[11] EPRI[12] and DOE[13], found that typical goals include:

- Increased deployment of DERs (including electric vehicles) and utilization of non-wires alternatives;
- Reduced outage frequency and duration;
- Increased system efficiency and asset utilization;
- Improved resiliency and security;
- Improved data access;
- Streamlined interconnection for DERs;
- Deployment of AMI;

[9] John Sterling, Christine Stearn, K Kaufmann, John van Zalk, *Blueprints For Electricity Market Reform; Building A Structure For Collaborative Stakeholder Discussions* (September, 2016).
[10] North Carolina Clean Energy Technology Center, *The 50 States of Grid Modernization: Q1 2017 Quarterly Report* (May 2017).
[11] Gridwise Alliance, *Advancing Batteries to Enhance the Electric Grid Chapter One: Front-of-Meter Applications* (July 2017).
[12] The Electric Power Research Institute, *Grid Modernization Resources*, *available at* http://www2.epri.com/Our-Work/Pages/Grid-Modernization.aspx.
[13] Department of Energy, *Grid Modernization Multi-Year Program Plan* (2015), *available at* https://energy.gov/sites/prod/files/2016/01/f28/Grid%20Modernization%20Multi-Year%20Program%20Plan.pdf.

- Deployment of energy storage; and
- Increased customer choice.

For example, in Massachusetts, all utilities were required to develop grid modernization plans focused on four objectives: (1) reducing the effects of outages; (2) optimizing demand, which includes reducing system and customer costs; (3) integrating distributed resources; and (4) improving workforce and asset management.[14] In Oregon, in concert with several other legislative efforts on grid modernization, H.B. 2193 of 2015 directed utilities serving 25,000 or more residential customers to procure one or more energy storage systems with the capacity to store at least 5 MWh of electricity to be used for resiliency improvement. The bill also directed the Public Utility Commission ("PUC") to adopt guidelines for utilities to use in submitting an energy storage proposal.

Depending on the types of goals established by the jurisdiction, accompanying metrics are often established. Examples of metrics include:

- Increased penetration of DERs, against a baseline scenario
- Increased capacity of battery storage, against a baseline scenario
- Decreased outage frequency and duration of a specific percentage, against a baseline scenario

Q. HAS THE COMPANY SET CLEAR AND MEASURABLE GOALS FOR THE POWER/FORWARD PLAN?

[14] Massachusetts Department of Public Utilities, Docket 12-76, June 12, 2014 Order at p. 2, *available at* http://170.63.40.34/DPU/FileRoomAPI/api/Attachments/Get/?path=12-76%2fOrder_1276B.pdf.

A. No. To date, the Company has yet to put forward clear and measurable goals with which to assess the Power/Forward investment plans. The Company has put forward a few vague objectives within its proposal but the Company has not articulated definitive goals nor has it submitted metrics. Company Witness Simpson states that Power/Forward investments will focus on projects that:

- Improve the reliability and hardiness of the system while making it smarter
- Build a foundation for customer focused innovation and new technologies
- Comply with prescriptive federal transmission reliability and security standards
- Address maintenance requirements for aging assets
- Further integrate and optimize intermittent distributed renewable generation[15]

The closest the Company comes to defining a clear metric is in relationship to the frequency and duration of outages. The Company posits that Power/Forward investment will improve System Average Interruption Frequency Index ("SAIFI") and System Average Interruption Duration Index ("SAIDI").[16] However, as the Company admits, no detailed metrics or associated benefits have been calculated.

[15] Simpson Direct, p. 26.
[16] DEP Response to CIGFUR DR2-10.

> Based on the preliminary planning completed for the Power/Forward Carolinas program and assuming that investments are completed as planned during the 10-year period, DEP estimates a decrease in outage events across the distribution system with a corresponding decrease in SAIFI and SAIDI metrics as compared to the system without the grid investments. However, the Company is still in the process of quantifying the applicable benefits.[17]

I should note that the Company continually points to the need to improve SAIDI and SAIFI as justification and driving reason for Power/Forward investments. However, a review of the Company's historical SAIFI and SAIDI[18] against recent analysis by the National Rural Electric Cooperative Association [19] shows that the Company is average or only slightly above average for nationwide, normalized scores. While this comparison does not mean that the Company should not invest in improved reliability, but rather that it is not an imminent need and that the Company has time to develop a stronger approach to grid modernization with clearer and more meaningful goals.

Furthermore, I should note that despite providing no clear goals or metrics on how to determine the effectiveness of the Power/Forward proposal for customers, the Company has been able to quantify the impact of the investment

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[17] *Id.*
[18] *Id.*
[19] Tony Thomas, National Rural Electric Cooperative Association, *2016 Distribution Reliability Study*, Presentation at 2017 IEEE PES General Meeting, *available at* http://grouper.ieee.org/groups/td/dist/sd/doc/2019-07-19%20NRECA%202016%20Distribution%20Reliability%20Study%20Results%20-%20Tony%20Thomas.pdf.

plan on Earnings per Share, Dividend contribution, and investor growth rate since the plan was first announced to shareholders in February 2017.[20]

Q. WHAT IS THE DANGER OF THE COMPANY NOT SETTING CLEAR, MEASURABLE GOALS?

A. Without clear and measurable goals there is no way to assess whether the investment proposals made by the Company are prudent investments, there is no way to assess the validity or the usefulness of a proposed investment, and most importantly without clear goals and metrics there is no way for the Commission to have oversight as to whether the ratepayer money spent is being spent for a good reason or providing a benefit.

B. Stakeholder Engagement.

Q. WHAT IS A STAKEHOLDER PROCESS AND WHY IS IT IMPORTANT?

A. A stakeholder process brings together market and non-market experts in the field of grid modernization with the utility and regulators to define and chart a clear pathway for modernizing the grid. While stakeholder processes can vary, the goal of the stakeholder process is to determine the elements and process of modernizing the grid. Topics may include: (1) Defining clear goals and metrics for the grid modernization process; (2) Increasing the transparency of distribution system planning; (3) The role and value of DERs; and (4) Modifications to the utility business model including tariffs and financial incentives and customer choice.

[20] Duke Energy, *Fourth Quarter Earnings Review and Business Update* (February 16, 2017), *available at* https://www.duke-energy.com/_/media/pdfs/our-company/investors/news-and-events/2017/1qresults/4q2016slidesr2.pdf?la=en.

The benefit of a stakeholder process is to receive outside information on technologies, options, and strategies for grid modernization. Additionally, a strong stakeholder process should create an open dialog on key grid modernization topics, and attempt to reach as much agreement as possible on opportunities for advancing grid modernization.

From my review, almost every grid modernization processes occurring in this country has some form of a stakeholder process that involves market and non-market participants with the purpose of determining an optimal pathway to achieving grid modernization goals. Examples of strong stakeholder processes include:

- Illinois, NextGrid
- Ohio, Power/Forward
- Minnesota, Investigation into Grid Modernization and Integrated Distribution Planning
- New Hampshire, Grid Modernization
- New York, Reforming the Energy Vision
- Rhode Island, Power Sector Transformation
- California, Distribution Resource Planning Proceedings

I should add that Duke Energy Ohio is currently engaged in a stakeholder process for its proposed Power/Forward plan. In Ohio, the Public Utility Commission is holding a series of stakeholder engagement forums to review the

latest in technological and regulatory innovation that could serve to modernize the grid.

Q. HAS THE COMPANY ENGAGED IN ANY STAKEHOLDER PROCEEDING TO DETERMINE A PATHWAY FOR GRID MODERNIZATION OR TO REVIEW PROPOSED POWER/FORWARD INVESTMENTS?

A. No. To the best of my knowledge, the Company has not engaged in a single stakeholder process (as defined above) or considered the input of third-parties in crafting the Power/Forward plan.

C. Integrated Distribution Planning.

Q. WHAT IS INTEGRATED DISTRIBUTION PLANNING AND WHY IS IT IMPORTANT FOR GRID MODERNIZATION?

A. Integrated distribution planning is a process that utilities undergo to map out their existing systems through a detailed engineering assessment, at the highest resolution, of the current and forecasted dynamics of the grid under multiple scenarios. The purpose of integrated distribution planning is to identify infrastructure changes that may be needed to achieve grid modernization goals. To properly plan for a grid of the future, and the impact of new technologies, integrated distribution planning must include forecasting and assessment of the role of DERs.

Thoughtful integrated distribution planning is transparent and participative and can enable the inclusion of more effective investments as well as increase

opportunities for third-party participation. There are several resources available to help guide integrated distribution planning, including:

- "Distribution Systems in A High Distributed Energy Resources Future" by Lawrence Berkeley National Laboratory;
- "Integrated Distribution Planning Concept Paper" by the Interstate Renewable Energy Council;
- "Integrated Distribution Planning – A Holistic Approach to Meeting Grid Needs and Expanding Customer Choice by Unlocking the Benefits of Distributed Energy Resources" by SolarCity;
- "It's All in the Plans: Maximizing the Benefits and Minimizing the Impacts of DERs in an Integrated Grid" by Smith, Rylander, Rogers, and Dugan;
- "More Than Smart: A Framework to Make the Distribution Grid More Open, Efficient and Resilient" by the Greentech Leadership Group; and
- "Planning the Distributed Energy Future" by Black & Veatch and the Solar Electric Power Association.

The output from integrated distribution planning is essentially the road map for optimizing the most efficient investments in the grid, and many states recognize its importance. For example, Minnesota's investigation into grid

modernization has a specific focus on integrated distribution system planning[21]. Rhode Island's Power Sector Transformation initiative has a work-stream dedicated to distribution system planning improvements.[22]

Q. HAS THE COMPANY CONDUCTED ROBUST INTEGRATED DISTRIBUTION PLANNING TO LEGITIMIZE THE INVESTMENTS PROPOSED?

A. No. To the best of my knowledge, the Company has not conducted any integrated distribution planning (as defined above), nor does it propose to conduct any integrated distribution planning before spending billions of ratepayers' dollars on grid investments. From my review, the Company does not even have readily available data on the number of circuit miles recently inspected, the number of overhead wires it has recently replaced, the number of transformers recently replaced, or the number of pad mount transformers recently replaced.[23] In my opinion, I do not see how the Company can make wise and targeted investments with the ratepayers' money without a better understanding of how it is currently spending ratepayer dollars.

Furthermore, the Company has yet to consider the potential for DERs, including energy efficiency, demand response, distributed generation, energy storage, microgrids, and other technologies, as cost effective means to eliminate

[21] *Staff Report on Grid Modernization*, Minnesota Public Utilities Commission (March, 2016), *available at* http://morethansmart.org/wp-content/uploads/2015/06/MNPUC_Staff_Report_on_Grid_Modernization_March2016.pdf.
[22] *Distribution System Planning* State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers, *available at* http://www.ripuc.org/utilityinfo/electric/DSP.html.
[23] Duke Energy Progress Response to Public Staff Data Request No. 108-2 (attached as Exhibit CG-5).

the need for many of the Company's proposed investments as well as enhance the overall economic efficiency of the grid, and strengthen the economy and electric system in North Carolina. Given that 38% of the Company's Power/Forward investment portfolio is for undergrounding power lines and that distributed resources, including solar and storage, have been proven to improve reliability and save ratepayers money, it is premature for the Company to spend billions of the ratepayers' dollars without first assessing alternative options.

For example, following Hurricane Sandy, the National Renewable Energy Laboratories assessed the role of distributed generation and storage in improving resilience to storm-related damage in New Jersey. NREL found that several critical infrastructure sites, if outfitted with distributed generation and storage, would allow for the independent operation during future disaster events.[24]

D. Cost/Benefit Analyses.

Q. WHAT ARE COST/BENEFIT ANALYSES AND WHY ARE THEY NEEDED IN GRID MODERNIZATION INVESTMENTS?

A. Cost/benefit analyses, as they relate to grid modernization investments, are simply an appraisal of the costs, including the opportunity costs, and benefits of investing in a specific technology. Cost benefit analysis should be conducted for the purpose of each investment independently, and in combination with other complementary or supporting investments. Cost benefit analyses are utilized to

[24] E. Hotchkiss, I. Metzger, J. Salasovich, & P. Schwabe, *Alternative Energy Generation Opportunities in Critical Infrastructure New Jersey*, NATIONAL RENEWABLE ENERGY LABORATORY (November 2013), *available at* http://www.Sustainablejersey.com/fileadmin/media/Events_and_Trainings/Add_Event/2013/HMGP_Workshop/FEMA_GORR_Proposal_from_NREL_FINAL.pdf.

determine if the proposed investments achieve the definitive goals of the grid modernization proposal. At minimum, cost benefit analyses include a business case analysis on the impacts of the proposed grid modernization investments against a baseline scenario where no grid modernization investments are made. For example, in Nevada, as part of the grid modernization process, S.B. 145 requires utilities to submit grid modernization plans with cost/benefit analyses and authorizes the Commission to approve these plans if the benefits exceed costs.[25] California law requires its Public Utilities Commission to only approve grid modernization expenditures that are just and reasonable and provide net benefits to ratepayers.[26]

Q. HAS THE COMPANY CONDUCTED COST/BENEFIT ANALYSES FOR POWER/FORWARD INVESTMENTS OR BUSINESS CASE ANALYSES?

A. No. To date, the Company has not conducted a single cost/benefit analysis or business case analysis.[27] The Company states, "DEP has not prepared detailed cost/benefit analyses for the Power/Forward programs."[28]

Q. WHAT ARE THE RISKS OF NOT CONDUCTING THOROUGH COST/BENEFIT ANALYSES BEFORE INITIATING THE POWER/FORWARD INVESTMENTS?

A. Proceeding with an investment of the magnitude without such significant and customary information heightens the risk of poor investment decisions and,

[25] See S.B 145: https://www.leg.state.nv.us/App/NELIS/REL/79th2017/Bill/4981/Overview.
[26] California Public Utilities Code § 769(d).
[27] DEP Response to NCSEA DR5-14; DEP Response to CIGFUR DR2-10.
[28] DEP Response to CIGFUR DR2-10.

ultimately, wasting ratepayer dollars. For example, currently the Company is proposing to spend $2.06 billion on undergrounding power lines. This proposal has been put forward without a clear goal or metric for assessment, without any integrated resource planning, and without cost/benefit analysis. Undergrounding power lines is an investment that has clear tradeoffs and implications for the resilience of the grid. In the Power/Forward proposal, the Company promotes the undergrounding of power lines as the solution to reliability concerns. However, this stands in contradiction to conclusions previously made by the Company:

> However, as underground systems age, the frequency of interruptions increases. . . . underground systems experience an increase in the duration and frequency of outages caused by flooding that occurs with hurricanes or significant precipitation events.[29]

This example only reaffirms the importance of thorough cost/benefit analyses, with stakeholder engagement, to ensure prudent, purposeful, and effective use of ratepayer dollars.

Q. PLEASE COMPARE THE APPROACH TAKEN BY THE COMPANY, IN TERMS OF POLICY PROCESS, TO OTHER JURISDICTIONS THROUGHOUT THE COUNTRY.

A. I have reviewed several if not all of the current grid modernization proceedings transpiring throughout the country. While not all jurisdictions are engaging in all the best practices outlined above, my review finds that nearly every other jurisdiction is following at least two of these 'best practice' procedural

[29] Progress Energy Carolinas' Response to Ice Storm Data Request No. 1 (Jan 15, 2003), *available at* http://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=944bbe54-19f2-4330-8e29-a63b19ac8f9e.

components. Additionally, I should note that many of the jurisdictions I have reviewed are in different stages of the process and may not have executed on all procedural components, but intend to. In contrast, the Company has yet to embark on any of these procedural components.

Table 1. Grid Modernization Process Components, Comparison by Active States.

	Stakeholder Process	Cost/Benefit Analysis	Defined Goals and/or Metrics	Integrated Distribution Planning
AZ	x	x		
CA	x	x	x	x
CO	x			
DC	x		x	x
HI	x	x		x
ID	x			
IL	x			x
MA	x	x	x	x
MD	x			x
MN	x		x	x
NH	x	x	x	x
NY	x	x	x	x
OH	x		x	
PA	x			
RI	x			x

Q. ARE THERE ANY OTHER ASPECTS OF THE GRID MODERNIZATION PROCEEDINGS THAT YOU HAVE REVIEWED THAT YOU BELIEVE ARE RELEVANT TO THE POWER/FORWARD PROPOSAL?

A. Yes. Many of the jurisdictions I reviewed, including Rhode Island, Texas, New York, California, and Arizona, are examining the role of the utility business model and the standards used to assess cost recovery for grid modernization investments.[30] More broadly my review highlighted the consistent recognition that investments in grid modernization technologies have the purpose of providing services but the optimization of those services are dependent on the actions taken by the utility. Historically the business model of investor owned utilities, like the Company, allows the utility to earn a return on investment for monies spent on infrastructure and not on the execution of services. Given that much of the purpose of grid modernization investments is to offer new, improved, and expanded services to the ratepayer, it is advisable to also examine under what business model and what mechanisms of regulatory assessment are most appropriate to ensure the best use of ratepayer dollars.

Q. WHY IS THE COMPANY'S FAILURE TO FOLLOW THE IDENTIFIED BEST PRACTICES OF GRID MODERNIZATION IN CONTRADICTION WITH THE TENETS OF SOUND RATEMAKING?

[30] For a thorough discussion of why the standard of 'used and useful' may not be an adequate standard for assessing grid modernization investments, *see* Direct Testimony of Paul J. Alvarez on Behalf of Environmental Defense Fund, p. 8.

A. According to the Regulatory Assistance Project,[31] rate design in the wake of new technologies and changes in ratepayer behavior should balance the goals of:

- Assuring recovery of utility prudently incurred costs;
- Maintaining grid reliability;
- Assuring fairness to all customer classes and subclasses;
- Assisting the transition of the industry to a clean energy future;
- Setting economically efficient prices that are forward looking and lead to the optimum allocation of utility and customer resources;
- Maximizing the value and effectiveness of new technologies as they become available and are deployed on, or alongside, the electric system; and
- Preventing anti-competitive or anti-innovation market structures or behavior.

From my review of the Power/Forward proposal, more work is needed before the Company is upholding best practices in rate design. The Company has yet to demonstrate prudency in its investment proposal. The Company has yet to demonstrate how the Power/Forward investments will assist in a transition to a clean energy future. The Company has yet to demonstrate that the Power/Forward investments are the optimum investments for ratepayers. The Company has yet to conduct any analysis on the potential of future, or attempted to maximize the value of existing, technologies (including DERs). And the Company has yet to

[31] J. Lazar and W. Gonzalez, *Smart Rate Design for a Smart Future*, Regulatory Assistance Project (2015), *available at* http://www.raponline.org/document/download/id/7680.

examine how third-parties may provide more cost-effective pathways towards grid modernization or how ratepayer investments if utilized effectively could achieve modernization goals- which could limit the emergence of competition in the marketplace.

Q. WHAT IS THE DANGER FOR DUKE RATE PAYERS OF DUKE'S FAILURE TO FOLLOW THE BEST PRACTICES OF GRID MODERNIZATION?

A. The Company's failure to put forth a clear, justifiable, or legitimate plan for the Power/Forward plan is essentially a request for a blank check of the ratepayer dollars without any assurance that the investments are to the benefit of the ratepayers and not just to the benefit of the Company's shareholders.

IV. REVIEW OF POWER/FORWARD PLAN INVESTMENTS

Q. WHAT TYPES OF INVESTMENTS ARE TYPICALLY ASSOCIATED WITH GRID MODERNIZATION PLANS?

A. Grid modernization investments can range in type and scope. The most recent reports from NCCETC list:[32]

- Energy storage
- AMI
- Microgrid deployment
- Advanced Distribution Planning tools, including enhanced load forecasting and hosting capacity analysis to determine how much

[32] North Carolina Clean Energy Technology Center, *The 50 States of Grid Modernization: Q1 2017 Quarterly Report* (May 2017).

DER a distribution system can accommodate without requiring upgrades

- Volt/VAR optimization
- Communication and automation technologies

Q. FROM YOUR REVIEW OF THE COMPANY'S POWER/FORWARD PLAN, DO THE PROPOSED INVESTMENTS FALL UNDER THE PURVIEW OF GRID MODERNIZATION?

A. From my review, some of the investments proposed in the Power/Forward plan are within the scope of grid modernization investments. However, without more thoughtful planning, robust integrated distribution planning, and cost/benefit analyses, I am unable to assess or conclude what clear benefits these investments will provide and whether these are the most cost effective investments. That being said, the following investments fall under the purview of grid modernization, including:

- AMI
- Automated switches and grid sensors
- A Distribution Management System

However, several of the investments proposed by the Company DO NOT reflect a commitment to modernizing the grid but rather are just continuations of historical business practices, including:

- Distribution hardening and resiliency, including vegetation management

- Undergrounding circuit segments

For example, since 2013, the Company has spent a total of $439 million on distribution capital expenditures for "maintenance, reliability, and integrity."[33] This is 26% of the total planned spend for Power/Forward plan for the next five years,[34] meaning that in the past 5 years, the Company has spent roughly a quarter on maintaining the reliability and integrity of the grid as it plans to spend over the next five years on Power/Forward investments, not including the additional millions of dollars it will spend on planned O&M. More importantly, many of the investments made between 2013-2016 are the exact same types of investments now proposed under the Power/Forward plan, including pole replacements, transformer retrofits, cable replacement, overhead wire replacement, and transformer capacity expansion. The Company is trying to reclassify historical, 'business as usual investments,' as modernization investments and titling them 'Distribution Hardening and Resiliency' with a new larger price tag.

Q. DOES THE COMPANY PROPOSE TO INVEST IN DERS OR UTILIZE EXISTING DERS FOR GRID SERVICES?

A. The Company does not propose to invest in any DERs or explore how existing DERs can be utilized as tools to achieve grid functionality or alternative investments to expanding capacity at substations, reducing outages, or improving resilience and reliability.

[33] Duke Energy Progress Response to Public Staff Data Request No. 47-3.
[34] Duke Energy Progress Response to NCSEA Data Request No. 5-9.

Q. DO THE POWER/FORWARD INVESTMENTS REFLECT A RESPONSIBLE AND REASONABLE APPROACH TO MODERN GRID FUNCTIONALITY?

A. No.

IV. RECOMMENDATIONS AND CONCLUSIONS.

Q. PLEASE SUMMARIZE YOUR EVALUATION OF DEP'S POWER/FORWARD PLAN.

A. The Company has not provided a plan with sufficient detail for any intervening party to thoroughly or thoughtfully assess. There is no technology detail, no cost benefit analysis, no integrated distribution planning, no clear objectives, and no clear metrics. There is not even a detailed list of the specific proposed investments. Additionally, the plan does not seek to invest in innovative technologies or DERs, but leans heavily on traditional capital investments that will simply prolong the traditional approach to distribution system planning and management and reflects a tendency towards 'business as usual' investment, not modernization.

The Company's Power/Forward plan, both in terms of the 'types' of investments and the process of determining the reasonableness of investments, is markedly different from other jurisdictions throughout the country. In my opinion, the Company's plan to date is deeply flawed, and wholly unsubstantiated.

Q. GIVEN YOUR EVALUATION, DO YOU HAVE ANY RECOMMENDATIONS FOR THE COMMISSION REGARDING DEP'S POWER/FORWARD PLAN?

A. Yes. Before moving forward with any Power/Forward investments, there must be a formal process to create the opportunity for a more thoughtful assessment. I recommend that the Commission order open a stand-alone docket to thoroughly and thoughtfully define and plan for a modernized grid. The proceeding should be executed in tandem with a formal study, either the study proposed in S.B. 619 or a similar study executed by the Commission.

The stand-alone docket should be predicated on clear grid modernization goals and metrics. Duke should be required to conduct robust integrated distribution planning that takes a holistically view of the grid and the technologies that are capable of meeting grid needs. This includes the proper forecasting and evaluation of the role of DERs, the inclusion of third parties, and transparency in the analysis process. Integrated distribution planning should be accompanied by thorough cost/benefit analyses that compare several investment pathways to meeting grid modernization goals, including the utilization of DERs.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

Caroline Golin
caroline@votesolar.org
www.votesolar.org

SUMMARY

Caroline Golin is the Southeast Regulatory Director for Vote Solar. Vote Solar is a non-profit organization working to foster economic opportunity and promote energy security by making solar a mainstream energy resource.

Caroline is a renewable energy policy expert with a focus on regulatory issues concerning distributed resources. Caroline's research has informed energy policy adoption and business practices at the local, state, and national levels, with recommendations adopted by several companies, cities and states. She has published and authored several studies related to the field of energy policy, renewable energy, the water-energy nexus, and the environmental impacts of energy and water use.

Areas of Expertise include:

- Distributed Energy Policy: Rate Design, Regulatory Challenges, Program Design, and Valuation
- Distributed Resource Planning
- Environmental Economics of Energy Generation

EDUCATION

Doctorate in Energy Policy. *Georgia Institute of Technology*, 2017.

Masters in Civil and Environmental Engineering (MSCE*). Georgia Institute of Technology*, 2014.

Bachelors of Arts (BA). *University of Florida*, 2007.

PAST ACTIVITIES

The Greenlink Group. Founder/CEO, September 2014 – April 2017

Principal Consultant and expert witness providing consulting services related to distributed resource policy and methods for quantifying policy impacts, with analytical experience in distributed solar policies.

Co-Creator of the ATHENIA Model, an integrated systems-environmental-economic modeling tool that can project hourly and daily social costs and benefits of energy and water policy shifts at the city, state, and utility scale.

Provide analysis and consultation related to utility filings, commission proceedings, and integrated resource planning on issues of rate design, policy, and generation investments in Virginia, Tennessee, North Carolina, South Carolina, Massachusetts, Rhode Island, Washington D.C, Ohio, and Georgia.

Provide analysis related to valuing distributed solar resources and community solar as well as consult on adoption in Tennessee, South Carolina, and Georgia.

Developed community solar program designs in Georgia and North Carolina, focusing on investor-owned utility models.

Provide expert testimony on the methods of valuing distributed resources, including the calculation of utility financials, rate impacts, avoided energy costs, avoided capacity costs, and the environmental externalities associated with traditional generation sources.

Provide consultation and analysis to cities on the most effective and economic measures for reducing energy and water use, including Atlanta, Orlando, Washington D.C, and Kansas City.

National Science Foundation IGERT Fellow. Georgia Institute of Technology. August 2011- December 2016

Propriety research conducted on energy and water management for Coca-Cola
Created models to assess impacts of shifts in energy and water use for the integration of distributed resources, specifically distributed solar.

Research on the adoption of sustainable water resource management systems for the integration of water and energy infrastructure development on the ACF River Basin

Energy Analyst. Georgia Department of Agriculture. Atlanta, GA

Worked with the Georgia Department of Agriculture to assess the potential for bioenergy use and solar powered irrigation systems in Georgia.

RELEVANT ANALYSES. PRESENTATIONS, AND PUBLICATIONS

- Prepared Direct Testimony on behalf of Energy Freedom Coalition of America (Investigation by the Department of Public Utilities on its own motion as to the propriety of the rates and charges proposed by Western Massachusetts Electric Company d/b/a Eversource Energy D.P.U. 10-70 March, 2017)
- Golin, Caroline and Xiaojing Sun. *The potential for Demand-Side Resource in the District of Columbia*. Prepared for the Department of Energy and Environment- January 2016.
- Prepared Direct Testimony on behalf of Georgia Interfaith Power and Light (Workshop to Examine Issues related to the Value of Renewable and Distributed Energy Resources in preparation for the 2016 Georgia Power Company Integrated Resource Plan Docket No. 39732)
- Prepared Direct Testimony on behalf of Energy Freedom Coalition of America (Investigation by the Department of Public Utilities on its own motion as to the propriety of the rates and charges proposed by Massachusetts Electric Company and Nantucket Electric Company in their petition for approval of an increase in base distribution rates for electric service pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00 et seq-March, 2016)
- Prepared Direct Testimony on behalf of The alliance for Solar Choice (Review of Electric Distribution Design Pursuant to R.I. Gen. Laws § 39-26.6-24. Docket No. 4568 – October 23, 2015)
- Prepared Direct Testimony on behalf of The alliance for Solar Choice (Review of Electric Distribution Design Pursuant to R.I. Gen. Laws § 39-26.6-24. Docket No. 4568 – November 23, 2015)
- Prepared Rebuttal Testimony on behalf of The alliance for Solar Choice (Review of Electric Distribution Design Pursuant to R.I. Gen. Laws § 39-26.6-24. Docket No. 4568 – January 6, 2015)
- Golin, Caroline and Southern Environmental Law Center. 2015. *A Troubling Trend in Rate Design: Proposed Rate Design Alternatives to Harmful Fixed Charges.* December, 2015
- Golin, C., Cox, M., Brown, M., & Thomas, V. 2015. The water efficiency gap. *Sustainable Water Resources Management*, 1-10.

- Golin, C. 2016. *Assessing the 'Cost Shift' for Residential PV under different rate designs.* Out for Review
- Matt Cox and Caroline Golin. 2015. *Analyzing Kansas City's Building Energy Benchmarking & Reporting Draft Proposed Ordinance*
- Matt Cox and Caroline Golin. 2015. *Analyzing Orlando's Building Energy Benchmarking & Reporting Draft Proposed Ordinance*
- Prepared Interrogatories with Southern Environmental Law Center on behalf of Appalachian Voices and the Chesapeake Climate Action Network (No PUE-2015-0006).
- Golin, Caroline and Matt Cox. 2015. *Determining the Value of Solar in Georgia*
- UNC Nexus 2015: Water, Food, Climate and Energy Conference. Paper presenter: Water in the Wires.
- Prepared Direct Testimony of Caroline Golin on behalf of the Southern Alliance for Clean Energy (Docket 2014-246-E-December 10, 2014)
- Matt Cox and Caroline Golin. 2014. *The Impacts of Net Metering in South Carolina.* Presented as supporting evidence for Direct Testimony in Docket 2014-246-E-December 10, 2014 on behalf of the Southern Environmental Law Center
- Golin, Caroline (2014). Common Pollutants Impact Methodology. Original methodology submitted to the Tennessee Valley Authority Distributed Generation-Integrated Value Stakeholder Group.
- Golin, Caroline (2014). Water Use Impact Methodology. Original methodology submitted to the Tennessee Valley Authority Distributed Generation-Integrated Value Stakeholder Group.
- Golin, Caroline. The Greenlink Group (2014), Additional Explanation of Methodologies Underlying Additional Environmental Considerations Section, submitted by the Southern Environmental Law Center.
- C3E with MIT & Clean Energy Ministerial. 2014. Award Winner. The ForeSEE Model.
- Golin, Caroline, et al. 2013.*Toward a comprehensive framework for nanomaterials: An interdisciplinary assessment of the current Environmental Health and Safety Regulation regarding the handling of carbon nanotubes.* J. Chem. Health Safety
- Georgia Environmental Conference. 2012. Research presented on the Health Impacts of Coal-fired Electricity Production.
- Solar Power International Conference. 2012. Research presented on the Health Impacts of Coal-fired Electricity Production and Benefits of Distributed Solar.
- Golin, Caroline. 2012. *Towards the Full Cost of Coal: A review of the recent literature assessing the negative health care externalities associated with coal-fired electricity production.* Filed before the Georgia Public Services Commission- September 20, 2012.

Duke Energy Progress
Response to
Carolina Industrial Group for Fair
Utility Rates II Data Request
Data Request No. CIGFUR 2-11

Docket No. E-2, Sub 1142

Date of Request: **July 12, 2017**
Date of Response: **July 24, 2017**

☐ **CONFIDENTIAL**

☒ **NOT CONFIDENTIAL**

Confidential Responses are provided pursuant to Confidentiality Agreement

The attached response to CIGFUR II Data Request No. 2-11, was provided to me by the following individual(s): Virginia Boucher, Rates & Regulatory Strategy Manager, Rate Case Planning & Execution, and was provided to CIGFUR II under my supervision.

Heather Smith
Deputy General Counsel
Duke Energy Progress

Carolina Industrial Group for Fair Utility Rates II
Data Request No. 2
DEP Docket No. E-2 Sub 1142
Item No. 2-11
Page 1 of 1

CIGFUR 2-11

Request:

11. Using Duke Energy's current stock price, please provide the estimated earnings per share impact of each additional $1 billion in rate base.

Response:

Please see attached file, which calculates the impact of adding $1B in North Carolina rate base on EPS. There are no additional assumptions made as to the type of investment, depreciation expense, related O&M expense, property tax, cash working capital requirements, etc. The calculation uses the filed capital structure and the filed income tax rate, and assumes no regulatory lag. The share price and shares outstanding are as of 12:50 p.m. on 7/18/2017.

Further, please note that the Company's planned $13B investment will not result in a $13B increase to rate base. The Company expects there to be immediate accumulated depreciation and accumulated deferred taxes that will reduce the rate base amount.

CIGFUR 2 11 EPS for $1B.xlsx

CIGFUR Request 2-11

Estimated Earning Per Share Impact of Additional $1B in NC rate Base
Assumes $1B of additional rate base to North Carolina Retail using the Capital structure filed in this case and the income tax filed in this case. This is strictly a mathematical result that makes no assumptions for the type of investment that is made; assocated O&M or depreciation expense, property tax expense, cash flow considerations; income tax considerations, etc. and assumes no regulatory lag.

Description	Capital Structure	Cost/ Return	Weighted Cost/Return	Income Taxes Factor	After Tax Return	CIGFUR 2-11 NC Rate Base Increase	Income Impact	7/18/17 Duke Energy Shares Outstanding (1)	EPS	7/18/17 Duke Energy EPS (1)	% Change
Long-term debt	47.00%	4.17%	1.96%	0.629401	1.23%						
Common equity	53.00%	10.75%	5.70%	1.000000	5.70%	1,000,000,000	56,975,000	699,880,000	$ 0.08	$ 84.07	0.1%
Total	100.00%		7.66%		6.93%						
Income tax rate (NC-0104)				0.370599							
1 minus combined income tax rate				0.629401							

(1) 7/18/2017 12:50 pm eatern Market Watch data

Duke Energy Progress
Response to
NCSEA Data Request
Data Request No. NCSEA 5-14

Docket No. E-2, Sub 1142

Date of Request: **July 21, 2017**
Date of Response: **July 31, 2017**
Date of Response: **July 28, 2017**

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The attached response to NCSEA Data Request No. 5-14, was provided to me by the following individual(s): Melissa B. Culbreth, Director Distribution Operations Finance, and was provided to NCSEA under my supervision.

Heather Smith
Deputy General Counsel
Duke Energy Progress

NCSEA
Docket No. E-2, Sub 1142
DEP General Rate Case
NCSEA Data Request No. 5
Item No. 5-14
Page 1 of 1

NCSEA 5-14

Request:

On page 20 of his testimony, Witness Simpson testifies that "At the same time we are faced with replacing our aging assets, new technology has become available which can target areas of our system that most need improvement -- meaning highest impact for fewest reasonable dollars to see operational gains and resiliency."

Please provide any reports or cost-benefit analyses that support Witness Simpson's assertion that the Company's expenditures will have "highest impact for fewest reasonable dollars."

Response:

The Power Quality, Reliability and Planning organization uses the Enterprise Distribution System Health tool to review reliability performance. This tool provides the underlying basis for investments in our grid that most need improvement -- meaning highest impact for fewest reasonable dollars to see operational gains and resiliency. The objectives of the Enterprise Distribution System Health Tool are to:
1) take current good Reliability performance beyond a system level and assign a Reliability performance rating at the corridor level
2) develop and integrate non-Reliability performance ratings such as
a. Customer Satisfaction,
b. Vegetation Management, and
c. Asset Management;
3) and identify actionable areas for improvement. These areas for improvement include:
a. Opportunities to improve customer satisfaction: Identify pockets of customer dissatisfaction with reliability that negatively impact CSAT scores and then invest in the programs that will improve reliability performance, which should result in improved customer experience, reduce the number of reactive customer complaints, and ultimately improve customer satisfaction scores.
b. Opportunities to prudently spend the next dollar: Provide the information that Reliability Engineers and Distribution Planners can use to identify the best locations and best programs to maintain or improve reliability performance and customer satisfaction before repeated outages develop into major issues.

Duke Energy Progress
Response to
Carolina Industrial Group for Fair
Utility Rates II Data Request
Data Request No. CIGFUR 2-10

Docket No. E-2, Sub 1142

Date of Request: **July 12, 2017**
Date of Response: **July 24, 2017**

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Confidential Responses are provided pursuant to Confidentiality Agreement

The attached response to CIGFUR II Data Request No. 2-10, was provided to me by the following individual(s): Melissa B. Culbreth, Director Distribution Operations Finance, and was provided to CIGFUR II under my supervision.

Heather Smith
Deputy General Counsel
Duke Energy Progress

Carolina Industrial Group for Fair Utility Rates II
Data Request No. 2
DEP Docket No. E-2 Sub 1142
Item No. 2-10
Page 1 of 2

CIGFUR 2-10

Request:

10. Regarding the Power/Forward Carolinas program described by Witnesses Fountain and Simpson:
a. Please provide DEP's SAIFI from 2000 to 2016.
b. Please provide DEP's SAIDI from 2000 to 2016.
c. What incremental changes in SAIFI and SAIDI does DEP expect to achieve as a result of the Power/Forward Carolinas program?
d. What portion of the planned $13 billion in Power/Forward Carolinas expenditures does DEP anticipate spending to improve its SAIFI and SAIDI?
e. Please provide the estimated annual rate impacts, by North Carolina retail customer class, for 2018 through 2033 of the Power/Forward Carolinas program.
f. Please provide any cost-benefit studies prepared by or at the direction of DEP or Duke Energy regarding the Power/Forward Carolinas program, including any subsidiary program thereof.

Response:

a. See Attached.

CIGFUR II
DR2-10a_b.docx

b. See document above, which responds to both a. and b.

c. Based on the preliminary planning completed for the Power/Forward Carolinas program and assuming that investments are completed as planned during the 10-year period, DEP estimates a decrease in outage events across the distribution system with a corresponding decrease in SAIFI and SAIDI metrics as compared to the system without the grid investments. However, the Company is still in the process of quantifying the applicable benefits.

d. The Power/Forward Carolinas program represents investments for both Duke Energy Progress and Duke Energy Carolinas. The primary components of the Power/Forward program that are specifically planned to improve SAIFI and SAIDI are Distribution Hardening and Resiliency, Targeted Undergrounding and Self-Optimizing Grid. The DEP portion of the planned Power/Forward investments for those three programs is approximately $4.1 billion. Other components may support those programs in improving SAIFI, but would provide ancillary impact.

Carolina Industrial Group for Fair Utility Rates II
Data Request No. 2
DEP Docket No. E-2 Sub 1142
Item No. 2-10
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e. The Company does not have definitive rate impact numbers to provide, nor does the Company believe such numbers are relevant to this case since it has not requested any rate recovery for such investments. Moreover, any rate impact would be dependent upon the outcome of this case, the allocation methodology, and the timing of recovery.

f. DEP has not prepared detailed cost/benefit analyses for the Power/Forward programs. The Company is currently working on quantifying certain benefits for each of the applicable programs; however, additional information and decisions are required to prepare such analyses.

a. Please provide DEP's SAIFI from 2000 to 2016.

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1.76	1.33	1.47	1.39	1.55	1.63	1.48	1.27	1.23	1.46	1.37

Note: We do not have data readily available before 2006. Unless specifically noted otherwise, Duke Energy Distribution reliability metrics include all outages and exclude MEDs as defined by IEEE 1366.

b. Please provide DEP's SAIDI from 2000 to 2016.

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
140	100	120	115	131	134	136	108	123	150	159

Note: We do not have data readily available before 2006. Unless specifically noted otherwise, Duke Energy Distribution reliability metrics include all outages and exclude MEDs as defined by IEEE 1366.

Provided by Bob Dollar, Director PQR&I Planning and Governance

Duke Energy Progress

Response to
NC Public Staff Data Request Data
Request No. NCPS 108-2

Docket No. E-2, Sub 1142

Date of Request: September 12, 2017
Date of Response: September 27, 2017

[ ] **CONFIDENTIAL**

[X] **NOT CONFIDENTIAL**

Confidential Responses are provided pursuant to Confidentiality Agreement

The attached response to NC Public Staff Data Request No. 108-2, was provided to me by the following individual(s): Melissa B. Culbreth, Director, Distribution Operations Finance, Regulated Utilities Finance, and was provided to NC Public Staff under my supervision.

Heather Smith
Deputy General Counsel
Duke Energy Progress

North Carolina Public Staff
Data Request No. 108
DEP Docket No. E-2 Sub 1142
Item No. 108-2
Page 1 of 1

NCPS 108-2

Request:

Please provide a breakdown of the distribution capital expenditures for integrity and maintenance (shown as 26%) for the years 2013 through 2016. Please include the following for each year:

a. Cost of pole replacements and the number of poles replaced.
b. Cost of underground cable replacement and the approximate total length of cable replaced.
c. Cost of overhead wire replacement and the approximate total length of wire replaced.
d. Cost of overhead transformers and quantity replaced.
e. Cost of pad mount transformers and quantity replaced.

Response:

Total expenditures by year at the Process Level 6 with linkage back to the pie chart categories is provided in **Attachment 108-2&4 Summary Cost.** The process tree mapping the process ID level to the Process Level 6 rollup is also included in this attachment.

DR 108-2 and 4
Summary Cost.xlsx

Detailed project level charges for the integrity and reliability programs selected in 2. a-e and 4. b-d are included in the **Attachment 108 2&4 Detailed Cost**. The quantity data for each of the programs selected is provided in summary format in a separate tab. To pull in quantity data at the project number level requires a manual process of going into the work management system and pulling the quantities from the work order. This can be done on a sample basis.

DR 108 2 and 4
Detail Cost.xlsx

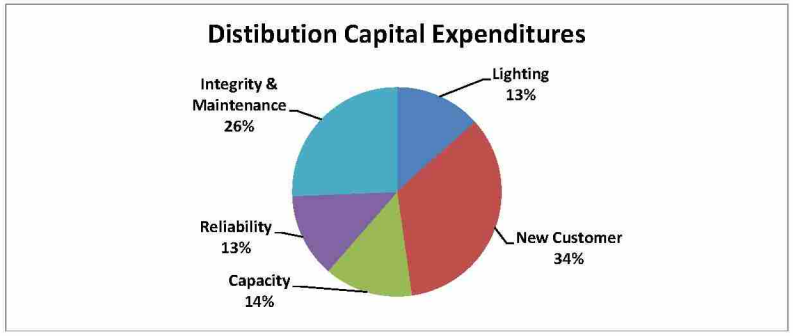
Carolinas Delivery Operations
Capital Cost Reports for Investment Allocation
($ in millions)

Pie Chart in the Testimony

	2013	2014	2015	2016	Total for 4 years	
Business Expansion	133.1	158.6	204.5	225.2	721.4	34%
Capacity	34.3	39.3	110.0	103.8	287.4	13%
Integrity	50.9	52.5	69.4	62.7	235.5	11%
Lighting	41.1	58.1	86.8	96.5	282.5	13%
Reliability (INCLUDE RUSD)	50.8	56.9	75.7	88.7	272.1	13%
Relocations	4.7	7.9	(4.1)	5.1	13.6	1%
Restoration	19.2	27.2	23.5	97.3	167.2	8%
Transformer & Meter Purchases	18.3				18.3	1%
R&I Engineering	5.5	14.3	21.8	20.8	62.4	3%
Other	5.5	1.3	10.8	10.8	28.4	1%
Business Support	1.4				1.4	0%
Veg Management	8.6	11.0	13.5	12.3	45.3	2%
Indirects		89.8	104.8	95.4	290.0	
	373.4	**516.9**	**716.7**	**818.6**	**2,425.6**	

		Pie Chart
Lighting	320.9	13%
New Customer	819.3	34%
Capacity	326.4	14%
Reliability	309.1	13%
Integrity & Maintenance	612.0	26%
	2,387.7	100%
	98%	

1.8 DEC Investment
1.2 DEP Investment
3.0 Total Distribution invenstment per FERC analysis
(0.2) Meters not inlcuded in Management View Analysis
(0.2) Load control and cust prem equipment not included in Management View
(0.2) Some of 362 Station Equipment is in the Transmission Budget
2.4 Management View Expenditures Pie Chart



Note 1 - The percentages for DEP- only numbers vary slightly from the percentages for Carolinas System which was the basis for the testimony pie chart
Note 2 - Go to the Process ID Tree tab to see a listing of the processes "programs" that roll to the process level 6 shown in this summary

Pie Chart		Process Level 6 Node Name LVL	2013	2014	2015	2016	TOTAL	DEP Only	Note 1 Carolinas
Capacity	Capacity	RETAIL CAPACITY		4,275,190	38,531,851	38,683,897	81,490,939		
	Capacity	RETAIL_CAPACITY		3,190,029			3,190,029		
	Capacity	RETAIL_SERVICES		2,169	2,656	9,423	14,249		
	Capacity	SYS_CAPAC_REGION_SUB				8,021	8,021		
	Capacity	SYSTEM CAPACITY - T		2,189,492	3,118,789	1,065,206	6,373,487		
	Capacity	SYSTEM_CAPACITY_D	9,228,932	6,824,877	14,023,029	20,005,759	50,082,597		
	Capacity	SYSTEM_CAPACITY_FO		4,443,012	2,334,866	1,266,778	8,044,656		
Capacity Total			9,228,932	20,924,770	58,011,191	61,039,084	149,203,977	14%	14%
Integrity & Maintena	Maintenance			747,296	6,624,524	3,659,738	11,031,558		
	Maintenance	2014 MAJOR STORMS		4,050	230	0	4,280		
	Maintenance	2016 MAJOR STORMS				18	18		
	Maintenance	BLDG-SUBSTATION		14,809			14,809		
	Maintenance	BUS_SUP_OTHER	880,172	123,555	55,397	13,041	1,072,166		
	Integrity	CABLE_REPL	17,837,908	18,103,729	23,478,786	12,603,034	72,023,457		
	Integrity	CABLE_REPL_MAJOR		0			0		
	Maintenance	DIST VM HAZ TREE CAP		1,379,859	2,372,591	1,679,889	5,432,339		
	Maintenance	DIST VM IN STAFF CAP		195,025	244,697	241,083	680,805		
	Maintenance	DIST VM INT STAFF OM				0	0		
	Maintenance	DIST VM MNT CAPITAL		1,748,483	2,419,227	1,854,136	6,021,846		
	Integrity	INTEGRITY_PROJECTS		0	4,339		4,339		
	Maintenance	IPP_INTERCONNECTIONS	(352,621)	-218,145	(112)		-570,878		
	Maintenance	LOADSWITCH		2,633			2,633		
	Maintenance	MAJOR OUT_FU_D		969,840	382,808	76,219	1,428,867		
	Maintenance	METER SVC-LAB		216,108	262,613	730,949	1,209,670		
	Maintenance	NERC_LINE_INSP		25,987	171,347		197,334		
	Maintenance	OUTAGE FU_UG PRI		140	13,891	251	14,282		
	Maintenance	OUTAGE RESTORATION-D	6,853,982	11,878,053	10,233,581	73,854,760	102,820,376		
	Maintenance	OUTAGE_RESTR_CAP_R		7,171	5,527	20,546	33,244		
	Integrity	POLE_REPL - D	8,887,760	9,070,927	15,703,337	21,774,354	55,436,377		
	Maintenance	POLE_REPL _T		1,260	3,515	11,273	16,048		
	Maintenance	PROJECT_G		0	0	240,153	240,153		
	Maintenance	PROJECT_O&M		0	47,093	996	48,089		
	Maintenance	PROJ-O&M		2,661	3,258	59,674	65,593		
	Maintenance	PROJ-O&M-CAR-FO		7,143			7,143		
	Maintenance	R&I CAP_OTHER T		48,714			48,714		
	Integrity	R&I_ENGINEERING	940,374	5,640,844	9,195,395	7,187,845	22,964,458		
	Maintenance	RELOC_INCL_ENG_D	361,904	5,751,634	722,897	2,238,580	9,075,016		
	Maintenance	RELOCATIONS - T		-354	0	1,031	677		
	Maintenance	ROUTINE_OUTAGES_D		74	0		74		
	Maintenance	SG AUTO METERING			(163)		-163		
	Maintenance	SG DIST AUTOMATION		14,609	296		14,905		
	Maintenance	SMALL TOOLS	1,563,937	1,936			1,565,873		
		SME INS_MT		1,777	251	214	2,241		
		SWITCH GEAR REPLAC		94	115	22,286	22,494		
	Maintenance	T-COMM UPGRADE		343	420	1,444	2,207		
	Maintenance	TECH SUPPORT		1,308	1,601	12,165	15,074		
	Maintenance	TRANSFORMER				51	51		
	Maintenance	TRANSFPRECAP-CAPITAL		-57	34	4	-19		
	Maintenance	TRANSFPRECAP-O&MINST		41,300	13,916	0	55,216		
		TX REPLACEMENT		97,555	164,073	153,992	415,619		
	Maintenance	UOFF MNT ACTIVITIES		810	6,610	9,809	17,229		
	Maintenance	UOFF PROJECTS		243			243		
	Maintenance	WHOLESALE_DELIVERIES		76,989			76,989		
Integrity & Maintenance Total			36,973,417	55,958,402	72,132,095	126,447,535	291,511,449	27%	26%
Lighting		LIGHTING ENGINEERING		2,137,479	3,343,133	2,706,141	8,186,753		
		LIGHTING REPAIR OH			0		0		
		LIGHTING REPAIR-UG			0		0		
		LIGHTING REPLACE	3,183,335	4,892,306	5,844,449	4,495,074	18,415,164		
		LIGHTING UPGRADES		426,738	16,434,201	18,762,812	35,623,751		
		LIGHTING-TAR	18,296,917	27,041,753	27,540,938	30,951,422	103,831,029		
Lighting Total			21,480,252	34,498,276	53,162,721	56,915,449	166,056,697	15%	13%
NA		INACTIVE_VALUES		16,695	0	1,443	18,138		
		INDIRECT		0	0		0		
		INDIRECT_ALLOCATIONS		67,550	11,482	39,127	118,159		
		MW CONVERSION				28	28		
NA Total				84,245	11,482	40,598	136,325		
New Customer		CUST_ADD_C&I		3,685,588	40,892,995	39,499,555	84,078,138		
		CUST_ADD_OTHER		591,873	10,990,349	5,153,980	16,736,202		
		CUST_ADD_RES		5,810,352	47,265,616	54,215,173	107,291,141		
		CUSTOMER_ADDITIONS	53,960,580	61,622,176			115,582,756		

		Transformer Purchases	18,153,956				18,153,956		
		CUSTOMER_DELIVERIES		3,426	11,015	171	14,612		
New Customer Total			72,114,536	71,713,414	99,159,974	98,868,879	341,856,803	31%	34%
Reliability	Reliability	CIRCUIT SECTIONALIZA	1,241,454	1,814,907	3,780,033	3,439,781	10,276,176		
	Reliability	DSDR		1,597,013	3,626		1,600,639		
	Reliability	DTUG CAPITAL		656,485	799,576	667,090	2,123,151		
	Reliability	MAJOR RELIABILITY		40	49	22,306	22,395		
	Reliability	OH D EQ INST_MT			0		0		
	Reliability	OH RELIABILITY	16,667,681	19,980,458	19,774,355	14,084,616	70,507,110		
	Reliability	OTHER PD		1,328	0		1,328		
	Integrity	R&I CAPITAL_OTHER-D		3,897,374.2	6,969,842.7	9,303,147.0	20,170,364		
	Reliability	RECLOSER_MT	2,834,983	1,698,638	3,455,815	5,276,825	13,266,260		
	Reliability	REL_MAJ_CAPITAL_T		477,600	99,342	66,066	643,008		
	Reliability	TX_RETROFIT	1,295,717	1,138,777	7,756,301	2,939,565	13,130,360		
	Reliability	R&I CAPITAL_OTHER-D		1,670,303.2	2,987,075.4	3,987,063.0	8,644,442		
	Reliability	R&I_ENGINEERING	403,018	2,417,505	3,940,884	3,080,505	9,841,911		
Reliability Total			22,442,853	35,350,429	49,566,899	42,866,964	150,227,144	14%	13%
Grand Total			162,239,989	218,529,536	332,044,362	386,178,509	1,098,992,396		

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	Capacity	SYS_CAPAC_REGION_SUB				8,021	8,021		
	Capacity	SYSTEM CAPACITY - T		2,189,492	3,118,789	1,065,206	6,373,487		
	Capacity	SYSTEM_CAPACITY_D	9,228,932	6,824,877	14,023,029	20,005,759	50,082,597		
	Capacity	SYSTEM_CAPACITY_FO		4,443,012	2,334,866	1,266,778	8,044,656		
Capacity Total			9,228,932	20,924,770	58,011,191	61,039,084	149,203,977	14%	14%
Integrity & Maintena	Maintenance			747,296	6,624,524	3,659,738	11,031,558		
	Maintenance	2014 MAJOR STORMS		4,050	230	0	4,280		
	Maintenance	2016 MAJOR STORMS				18	18		
	Maintenance	BLDG-SUBSTATION		14,809			14,809		
	Maintenance	BUS_SUP_OTHER	880,172	123,555	55,397	13,041	1,072,166		
	Integrity	CABLE_REPL	17,837,908	18,103,729	23,478,786	12,603,034	72,023,457		
	Integrity	CABLE_REPL_MAJOR		0			0		
	Maintenance	DIST VM HAZ TREE CAP		1,379,859	2,372,591	1,679,889	5,432,339		
	Maintenance	DIST VM IN STAFF CAP		195,025	244,697	241,083	680,805		
	Maintenance	DIST VM INT STAFF OM				0	0		
	Maintenance	DIST VM MNT CAPITAL		1,748,483	2,419,227	1,854,136	6,021,846		
	Integrity	INTEGRITY_PROJECTS		0	4,339		4,339		
	Maintenance	IPP_INTERCONNECTIONS	(352,621)	-218,145	(112)		-570,878		
	Maintenance	LOADSWITCH		2,633			2,633		
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	Maintenance	NERC_LINE_INSP		25,987	171,347		197,334		
	Maintenance	OUTAGE FU_UG PRI		140	13,891	251	14,282		
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		LIGHTING-TAR	18,296,917	27,041,753	27,540,938	30,951,422	103,831,029		
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NA		INACTIVE_VALUES		16,695	0	1,443	18,138		
		INDIRECT		0	0		0		
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NA Total				84,245	11,482	40,598	136,325		
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		CUST_ADD_RES		5,810,352	47,265,616	54,215,173	107,291,141		
		CUSTOMER_ADDITIONS	53,960,580	61,622,176			115,582,756		

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		CUSTOMER_DELIVERIES		3,426	11,015	171	14,612		
New Customer Total			72,114,536	71,713,414	99,159,974	98,868,879	341,856,803	31%	34%
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	Reliability	DSDR		1,597,013	3,626		1,600,639		
	Reliability	DTUG CAPITAL		656,485	799,576	667,090	2,123,151		
	Reliability	MAJOR RELIABILITY		40	49	22,306	22,395		
	Reliability	OH D EQ INST_MT			0		0		
	Reliability	OH RELIABILITY	16,667,681	19,980,458	19,774,355	14,084,616	70,507,110		
	Reliability	OTHER PD		1,328	0		1,328		
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	Reliability	RECLOSER_MT	2,834,983	1,698,638	3,455,815	5,276,825	13,266,260		
	Reliability	REL_MAJ_CAPITAL_T		477,600	99,342	66,066	643,008		
	Reliability	TX_RETROFIT	1,295,717	1,138,777	7,756,301	2,939,565	13,130,360		
	Reliability	R&I CAPITAL_OTHER-D		1,670,303.2	2,987,075.4	3,987,063.0	8,644,442		
	Reliability	R&I_ENGINEERING	403,018	2,417,505	3,940,884	3,080,505	9,841,911		
Reliability Total			22,442,853	35,350,429	49,566,899	42,866,964	150,227,144	14%	13%
Grand Total			162,239,989	218,529,536	332,044,362	386,178,509	1,098,992,396		

Program Unit Data
Provided from the tactical report

Data Req	**Program**	**Process ID**		2013 **Units**	2014 **Units**	2015 **Units**	2016 **Units**
108-2a.	Pole Replacements	RLP/CSI	Each	2383	4,009	4,110	4,556
108-2b.	UG Cable Replacement	RUC/CBLREHB	Miles	81	73	65	63
108-2c.	OH Wire Replacement	DET/ROC	Miles	3	121	113	88
108-2d.	OH Transformer Replacement	ROR/RTR	Each	218	316	283	361
108-2e.	Padmount Transformer Replacement	RSR	Each	163	281	309	258
108-4b.	Transformer Retrofit	RXR	Each	0	212	7,440	7,474
108-4c.	Sectionalization Program	SYSICAP/RFS	Each	447	377	329	362
108-4d.	Self Healing Teams	SYSICAP/RFS	Each	0	20	32	27